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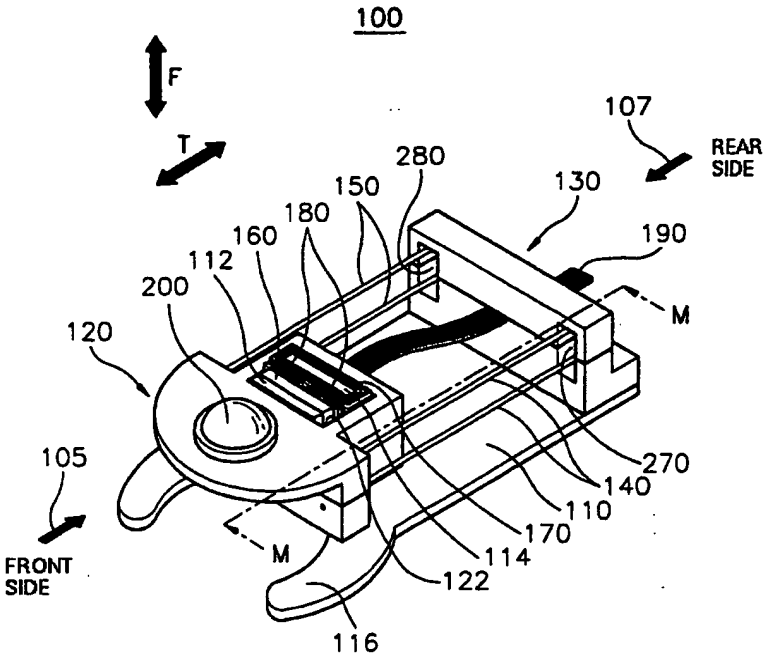
(54) Title: OPTICAL PICK-UP APPARATUS

(57) Abstract

An optical pick-up apparatus for a disc player which has a simple construction and can be manufactured in a small size. The optical pick-up apparatus has a yoke plate provided with a first yoke and a second yoke which are upwardly protruded, a permanent magnet attached to a rear surface of the first yoke, a focusing coil wound around the second yoke while leaving a predetermined space therebetween, a tracking coil attached to a front surface of the focusing coil so that the tracking coil faces the permanent magnet, a gel holder installed opposite to the first yoke, an object lens holder which is disposed above the yoke plate and surrounds the first and second yoke plates, a flexible PCB which is directly connected to both focusing and tracking coils in order to transfer an electric signal from an electric source to the focusing and tracking coils, and suspension wires for movably suspending the object lens holder. Both ends of the suspension wires are connected to recesses filled up with damping gels, so the optical pick-up apparatus easily absorbs the impact applied thereto while operating. The focusing and tracking coils are directly connected to the flexible PCB so that a complicated process for electrically connecting the focusing and tracking coils to the electrical source is not necessary.



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OPTICAL PICK-UP APPARATUS

TECHNICAL FIELD

The present invention relates to a disc player, and more particularly to an optical pick-up apparatus for a disc player which has a simple construction and can be manufactured in a small size.

BACKGROUND ART

An optical pick-up is an apparatus for recording information on an optical disc or reading the recorded information in the optical disc by using a laser beam. The optical pick-up is installed below the optical disc and linearly moves from a center of the optical disc to an outer periphery of the optical disc so as to detect a desired track position on the optical disc. By use of the optical pick-up, a beam radiated from a holographic element is introduced into a pit formed on a recording surface of the optical disc. When the beam is reflected from the optical disc, the optical pick-up detects a digital signal from the reflected beam through an optical system. The detected digital signal is converted to an analog signal by a D/A converter so that information recorded in the optical disc is reproduced.

Generally, the optical pick-up includes a light source for producing the laser beam, a beam splitter for directing the laser beam emitted from the light source toward an objective lens which focuses the laser beam on the surface of an optical disc, and a photo diode for receiving the laser beam reflected from the surface of the optical disc.

Information tracks, on which information is recorded, are concentrically or spirally formed on the recording surface of the optical disc, and the optical pick-up emits the laser beam onto the information tracks so as to record data on a predetermined position of the optical disc or to reproduce the data from the predetermined position.

In order to accurately record or reproduce the data, a focusing error control and a tracking error control should be performed. That is, the laser beam emitted onto the information track from the optical pick-up should trace the information track while the disc player is being operated. In addition, a distance between the

recording surface of the optical disc and the object lens should be constantly maintained. Thus, a disc recording/reproducing apparatus detects a servo error signal including a focusing error signal and a tracking error signal by utilizing the beam reflected from the information track, and then applies electric signals to both a focusing circuit and a tracking circuit based on the detected servo error signal, thereby moving the optical pick-up in the focusing and tracking directions.

FIG. 4 shows such a conventional optical pick-up 10. As shown in FIG. 4, conventional optical pick-up 10 includes a yoke plate 44, to which suspension support plates 46 are attached, and an objective lens holder 14 which is suspended above yoke plate 44 by means of suspensions 50 and supports an objective lens 12.

A laser beam through hole 45 is formed at the center of yoke plate 44 to allow the laser beam to pass therethrough, and a pair of inner yokes 38 and 40 and a pair of outer yokes 36 and 42 are arranged on yoke plate 44 in opposition to each other. Inner yokes 38 and 40 are respectively surrounded by focusing coils 24 and 26. Permanent magnets 32 and 34 are respectively arranged between inner yoke 38 and outer yoke 36, and between inner yoke 40 and outer yoke 42. Also, tracking coils 28 and 30 are respectively arranged between focusing coil 24 and permanent magnet 32, and between focusing coil 26 and permanent magnet 34. Suspension support plates 46 are attached to one end of yoke plate 44, and an end plate 48 is attached to the rear surface of suspension support plates 46.

Suspensions 50 are manufactured by conductive materials, and receives an electric current from a current source (not shown) through end plate 48. One end of each suspension 50 is fixed to end plate 48 by passing through suspension support plates 46, and the other end of each suspension 50 is fixed to support pieces 16 and 18 which are integrally formed with both sides of object lens holder 14.

Optical pick-up 10 constructed as described above operates as follows.

Firstly, when an optical disc, such as a CD, has been loaded in a cartridge of the disc player, optical pick-up 10 moves to a disc loading position by means of a driving device (not shown). Next, a laser beam is emitted toward a recording surface of the optical disc from a laser beam source (not shown) through object lens 12. Then, the laser beam is reflected from the recording surface and inputted into a photo detector (not shown).

Upon receiving the reflected laser beam, the photo detector detects a focusing error caused by vertical motion of the optical disc and a tracking error caused by a radial deviation of the optical disc and sends focusing and tracking error signals to a microcomputer (not shown). Then, in order to correct the focusing and tracking errors, the microcomputer sends an electric signal to both a focusing circuit and a tracking circuit so that an electric current is applied to both focusing coils 24 and 26 and tracking coils 28 and 30. When the electric current is applied to focusing coils 24 and 26, object lens holder 14 moves in a focusing direction F by means of an electromagnetic-interaction generated between permanent magnets 32 and 34 and focusing coils 24 and 26, thereby correcting the focusing error.

In addition, when the electric current is applied to tracking coils 28 and 30, object lens holder 14 moves in a tracking direction T by an electromagnetic-interaction between permanent magnets 32 and 34 and tracking coils 28 and 30, thereby correcting the tracking error.

However, in conventional pick-up apparatus 10, the pair of outer yokes 36 and 42 for fixing permanent magnets 32 and 34 thereto, the pair of inner yokes 38 and 40 for forming a magnetic closed circuit, and suspension support plate 46 for fixing end plate 48 thereto are provided in yoke plate 44, so yoke plate 44 on which the above elements are installed should be designed in a relatively large size.

In addition, the above elements are provided in yoke plate 44 by a bending work which is very complicated. Conventional optical pick-up 10 needs to carry out the bending work several times, so the working efficiency is decreased.

Furthermore, in conventional optical pick-up 10, the electric current is applied to focusing coils 24 and 26 and tracking coils 28 and 30 through suspension wire 50 which horizontally suspends object lens holder 14. To that end, one end of suspension wire 50 is fixed to end plate 48 by means of soldering, and the other end thereof is fixed to support pieces 16 and 18 by means of soldering. However, suspension wire 50 can be off-set from its horizontal position while the soldering is carried out, thereby causing object lens holder 14 to be tilted. Accordingly, the bad performance of optical pick apparatus 10 is resulted.

DISCLOSURE OF INVENTION

The present invention has been made to overcome the above described problem of the prior art, and accordingly it is an object of the present invention to provide an optical pick-up apparatus in which a suspension wire can be accurately installed in its horizontal position, in which a yoke plate can be manufactured with a simple construction, and in which an electrical connection between an electrical source and focusing and tracking coils can be simplified.

To achieve the above-described object, the present invention provides an optical pick-up apparatus comprising:

a yoke plate provided at a first end of an upper surface thereof with a first yoke and a second yoke which is disposed in a rear direction of the first yoke and spaced by a predetermined distance apart from the first yoke, the first yoke and the second yoke being upwardly protruded;

a permanent magnet attached to a rear surface of the first yoke;

a focusing coil wound around the second yoke while leaving a predetermined space therebetween;

a tracking coil attached to a front surface of the focusing coil in such a manner that the tracking coil faces the permanent magnet;

a gel holder installed on a second end of the upper surface of the yoke plate, the second end being opposite to the first end;

an object lens holder disposed above the first end of the upper surface of the yoke plate in such a manner that the object lens holder surrounds the first and second yoke plates;

a flexible PCB which is directly connected to both focusing and tracking coils in order to transfer an electric signal from an electric source to the focusing and tracking coils; and

a pair of first suspension wires and a pair of second wires which suspend the object lens holder and permit the object lens holder to move in a focusing direction or a tracking direction, the first and second suspension wires being provided between the gel holder and the object lens holder, the pair of the first suspension wires being spaced in parallel to the pair of the second suspension wires.

According to a preferred embodiment of the present invention, the object lens holder is formed with a rectangular opening within which the first and second

yokes are positioned. Both sides of the focusing and tracking coils are adhered to side walls of the rectangular opening.

The gel holder is formed at a front surface thereof with first and second recesses filled up with a damping gel, and the object lens holder is formed at a predetermined portion of a rear surface thereof with third and fourth recesses which are filled up with the damping gel and are positioned corresponding to the first and second recesses, respectively. First ends of the pair of first suspension wires are fixed to a rear surface of the gel holder by passing through the first recess, and second ends of the pair of first suspension wires, which are positioned opposite to the first ends, are fixed to a front surface of the object lens holder by passing through the third recess. Third ends of the pair of second suspension wires are fixed to the rear surface of the gel holder by passing through the second recess and fourth ends of the pair of second suspension wires, which are positioned opposite to the third ends, are fixed to the front surface of the object lens holder by passing through the fourth recess.

The object lens holder includes an upper object lens holder on which an object lens is installed and a lower object lens holder attached to an underside of the upper object lens holder.

The gel holder includes an upper gel holder and a lower gel holder attached to an underside of the upper gel holder. The upper gel holder is provided at the underside thereof with a pair of projections which are inserted into a pair of engage holes formed at an upper surface of the lower gel holder.

The laser beam emitted from a holographic element is directed into the object lens through a mirror section. The laser beam is converged onto the recording surface of a disc through the object lens and is reflected from the recording surface of the disc. Then, the reflected beam is inputted into the photo detector disposed in the holographic element. The photo detector detects tracking and focusing errors based on the reflected beam and sends tracking and focusing error signals to a microcomputer.

The microcomputer sends a current supply signal to the current source so that the current is applied to the tracking and focusing coils from the current source by way of the flexible PCB.

When the current is applied to the tracking/focusing coils, Lorentz force is generated between the tracking/focusing coils and the permanent magnet, so tracking/focusing coils move in tracking/focusing directions, thereby correcting the tracking/focusing errors.

The focusing control and tracking control are continuously carried out while the optical pick-up apparatus is being operated so as to precisely record/reproduce information onto/from the disc.

As described above, according to the optical pick-up apparatus of the present invention, the first and second suspension wires can be easily installed at the pick-up apparatus and can easily suspend the object lens holder in a horizontal state.

In addition, the optical pick-up apparatus easily absorbs the impact applied thereto while operating, so that the performance thereof is improved.

Furthermore, the focusing and tracking coils are directly connected to the flexible PCB so that a complicated process for electrically connecting the focusing and tracking coils to the electrical source is not necessary. As a result, the productivity of articles is improved.

In addition, since the yoke plate has a simple construction and can be manufactured in a small size, the optical pick-up apparatus can also be manufactured in a small size.

BRIEF DESCRIPTION OF DRAWINGS

The above object and other advantages of the present invention will become more apparent by describing in detail a preferred embodiment thereof with reference to the attached drawings in which:

FIG. 1 is an assembled perspective view of an optical pick-up apparatus according to one embodiment of the present invention;

FIG. 2 is an exploded perspective view of an optical pick-up apparatus shown in FIG. 1;

FIG. 3 is a side sectional view taken along line M-M in FIG. 1; and

FIG. 4 is a perspective view of a conventional optical pick-up apparatus.

BEST MODE FOR CARRYING OUT THE INVENTION

Hereinbelow, a preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings.

FIGs. 1 to 3 show an optical pick-up apparatus 100 according to the present invention. In this application, the front surface or the front side means a position corresponding to a front side of optical pick-up apparatus 100 as shown in FIG. 1 by an arrow 105, and the rear surface or the rear side means a position corresponding to a rear side of optical pick-up apparatus 100 as shown in FIG. 1 by an arrow 107.

Referring to FIG. 1, optical pick-up apparatus 100 has a yoke plate 110 provided at a first end of an upper surface thereof with a first yoke 112. A permanent magnet 160 is attached to a rear surface of first yoke 112, and a second yoke 114, which is spaced by a predetermined distance apart from first yoke 112, is disposed in a rear direction of first yoke 112. First yoke 112 is incorporated with second yoke 114 so as to form a magnetic closed circuit.

A focusing coil 170 is wound around second yoke 114 while leaving a predetermined space therebetween. A pair of tracking coils 180 are attached to a front surface of focusing coil 170 in such a manner that tracking coils 180 face permanent magnet 160. When an electric current is applied to focusing and tracking coils 170 and 180, an electro-magnetic force is generated between focusing and tracking coils 170 and 180 and permanent magnet 160. Preferably, tracking coils 180 are adhered to focusing coil 170 by means of an ultraviolet bonding. Each end portion of focusing and tracking coils 170 and 180 is directly connected to a flexible PCB 190 so as to receive the electric current from the electric source.

Disposed above the first end of the upper surface of yoke plate 110 is an object lens holder 120 on which an object lens 200 is installed. Object lens holder 120 is formed with a rectangular opening 122 within which first and second yokes 112 and 114 are positioned. Both sides of focusing and tracking coils 170 and 180 are adhered to side walls of rectangular opening 122.

A gel holder 130 filled up with a damping gel for reducing a vibration is installed on a second end of the upper surface of yoke plate 110. Gel holder 130 is formed at a front surface thereof with first and second recesses 270 and 280 filled up with the damping gel. In addition, object lens holder 120 is formed at a

predetermined portion of a rear surface thereof with third and fourth recesses which are filled up with the damping gel and are positioned corresponding to first and second recesses 270 and 280, respectively.

Between gel holder 130 and object lens holder 120, there are provided a pair of first suspension wires 140 and a pair of second wires 150 which suspend object lens holder 120 in such a manner that object lens holder 120 can move in a focusing direction F or a tracking direction T. First suspension wires 140 are spaced in parallel to the pair of second suspension wires 150.

As shown in FIG. 3, in detail, first ends of the pair of first suspension wires 140 are fixed to a rear surface of gel holder 130 by passing through first recess 270. In addition, second ends of the pair of first suspension wires 140, which are positioned opposite to the first ends, are fixed to a front surface of object lens holder 120 by passing through the third recess. As the same manner as first suspension wires 140, first ends of the pair of second suspension wires 150 are fixed to the rear surface of gel holder 130 by passing through second recess 280, and second ends of the pair of second suspension wires 150, which are positioned opposite to the first ends, are fixed to the front surface of object lens holder 120 by passing through the fourth recess.

In this manner, first and second suspension wires 140 and 150 can be easily installed at pick-up apparatus 100 and can easily suspend object lens holder 120 in a horizontal state.

In addition, since both ends of first and second suspension wires 140 and 150 are respectively connected to first through fourth recesses which are filled up with damping gels, first and second suspension wires 140 and 150 can absorb an impact which is applied thereto while optical pick-up 100 is being operated, so the performance of optical pick-up 100 is improved.

FIG. 2 shows an exploded perspective view of optical pick-up apparatus 100. As shown in FIG. 2, object lens holder 120 includes an upper object lens holder 220 on which an object lens seat 226 for installing object lens 200 is formed, and a lower object lens holder 230 attached to an underside of upper object lens holder 220. Upper object lens holder 220 is provided at the underside thereof with a pair of projections 223 which are inserted into a pair of engage holes 233 formed at an

upper surface of lower object lens holder 230. Upper and lower object lens holders 220 and 230 are respectively formed with upper and lower openings 222 and 223 forming rectangular opening 122. Lower opening 223 is formed at a rear inner wall thereof with a through hole 236 through which each end portion of focusing and tracking coils 170 and 180 extend out of object lens holder 120 so as to be connected with flexible PCB 190. In this manner, focusing and tracking coils 170 and 180 are directly connected to flexible PCB 190 so that a complicated process for electrically connecting focusing and tracking coils 170 and 180 to the electrical source is not necessary. As a result, the productivity of articles is improved.

In addition, upper object lens holder 220 is formed at a lower portion of a rear surface thereof with first and second reverse U-shaped cutting portions 228 and 229, and lower object lens holder 230 is formed at an upper portion of a rear surface thereof with first and second U-shaped cutting portions 238 and 239. First reverse U-shaped cutting portion 228 is incorporated with first U-shaped cutting portion 238 so as to form the third recess, and second reverse U-shaped cutting portion 229 is incorporated with second U-shaped cutting portion 239 so as to form the fourth recess.

On the other hand, gel holder 130 includes an upper gel holder 240 and a lower gel holder 250 attached to an underside of upper gel holder 240. Upper gel holder 240 is provided at the underside thereof with a pair of projections 244 which are inserted into a pair of engage holes 254 formed at an upper surface of lower gel holder 250.

At an upper surface of lower gel holder 250, there is formed a guide groove 258 through which flexible PCB 190 connected to focusing and tracking coils 170 and 180 is withdrawn out of optical pick-up apparatus 100. In addition, lower gel holder 250 is provided at an underside thereof with a pair of projection pins 256 which is inserted into a pair of engage holes 118 formed at the second end of the upper surfaces of yoke plate 110 so that lower gel holder 250 is fixed to the upper surface of yoke plate 110.

Upper gel holder 240 is formed at a lower portion of a front surface thereof with third and fourth reverse U-shaped cutting portions 242 and 243, and lower gel holder 250 is formed at an upper portion of a front surface thereof with third and

fourth U-shaped cutting portions 252 and 253. Third reverse U-shaped cutting portion 242 is incorporated with third U-shaped cutting portion 252 so as to form first recess 270, and fourth reverse U-shaped cutting portion 243 is incorporated with fourth U-shaped cutting portion 253 so as to form second recess 280.

The pair of first suspension wires 140 include an upper suspension wire and a lower suspension wire. A first end of the upper suspension wire is fixed to a rear surface of upper gel holder 240 by passing through third reverse U-shaped cutting portion 242, and a second end of the upper suspension wire is fixed to a front surface of upper object lens holder 220 by passing through first reverse U-shaped cutting portion 228. In addition, a first end of the lower suspension wire is fixed to a rear surface of lower gel holder 250 by passing through third U-shaped cutting portion 252, and a second end of the lower suspension wire is fixed to a front surface of lower object lens holder 230 by passing through first U-shaped cutting portion 238.

In addition, the pair of second suspension wires 150 also include an upper suspension wire and a lower suspension wire. A first end of the upper suspension wire is fixed to a rear surface of upper gel holder 240 by passing through second reverse U-shaped cutting portion 243, and a second end of the upper suspension wire is fixed to a front surface of upper object lens holder 220 by passing through second reverse U-shaped cutting portion 229. In addition, a first end of the lower suspension wire is fixed to a rear surface of lower gel holder 250 by passing through fourth U-shaped cutting portion 253, and a second end of the lower suspension wire is fixed to a front surface of lower object lens holder 230 by passing through second U-shaped cutting portion 239.

The pick-up apparatus having the construction as mentioned above operates as follows.

Firstly, the laser beam emitted from a holographic element (not shown) is directed into object lens 200 through a mirror section (not shown). The laser beam directed into object lens 200 is converged onto the recording surface of a disc through object lens 200 and is reflected from the recording surface of the disc. Then, the reflected beam is inputted into the photo detector disposed in the holographic element through object lens 200. The photo detector detects tracking

and focusing errors based on the reflected beam and sends tracking and focusing error signals to a microcomputer (not shown). Upon receiving the tracking and focusing error signals, the microcomputer sends a current supply signal to the current source so that the current is applied to tracking and focusing coils 170 and 180 from the current source by way of flexible PCB 190.

When the current is applied to tracking coils 180, a Lorentz force is generated between tracking coils 180 and permanent magnet 160, so tracking coils 180 move in tracking direction T. Since both sides of tracking coils 180 are adhered to side walls of rectangular opening 122 of object lens holder 120, object lens holder 120 moves in tracking direction T when tracking coils 180 move in tracking direction T, so that object lens 200 is arranged in an accurate track position, thereby correcting the tracking error caused by a radial deviation of the disc.

At the same time, the Lorentz force is generated between focusing coil 170 and permanent magnet 160 when the current is applied to focusing coil 170, so that focusing coil 170 moves in focusing direction F. As the same as tracking coils 180, since both sides of focusing coil 170 are adhered to side walls of rectangular opening 122 of object lens holder 120, object lens holder 120 moves in focusing direction F. Accordingly, object lens 200 mounted on the upper surface of object lens holder 120 moves in focusing direction F, thereby correcting the focusing error caused by a vertical motion of the disc.

The focusing control and tracking control are continuously carried out while the optical pick-up apparatus is being operated so as to precisely record/reproduce information onto/from the disc.

On the other hand, since both ends of first and second suspension wires 140 and 150 are respectively connected to the first through fourth recesses which are filled up with damping gels, an impact applied to optical pick-up apparatus 100 is easily absorbed while optical pick-up is being operated, thereby improving the performance of optical pick-up apparatus 100.

As described above, according to the optical pick-up apparatus of the present invention, the first and second suspension wires can be easily installed at the pick-up apparatus and can easily suspend the object lens holder in a horizontal state.

In addition, the optical pick-up apparatus easily absorbs the impact applied

thereto while operating, so that the performance thereof is improved.

Furthermore, the focusing and tracking coils are directly connected to the flexible PCB so that a complicated process for electrically connecting the focusing and tracking coils to the electrical source is not necessary. As a result, the productivity of articles is improved.

In addition, since the yoke plate has a simple construction and can be manufactured in a small size, the optical pick-up apparatus can also be manufactured in a small size.

While the present invention has been particularly shown and described with reference to the preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be effected therein without departing from the spirit and scope of the invention as defined by the appended claims.

CLAIMS

1. An optical pick-up apparatus comprising:

a yoke plate provided at a first end of an upper surface thereof with a first yoke and a second yoke which is disposed in a rear direction of the first yoke and spaced by a predetermined distance apart from the first yoke, the first yoke and the second yoke being upwardly protruded;

a permanent magnet attached to a rear surface of the first yoke;

a focusing coil wound around the second yoke while leaving a predetermined space therebetween;

a tracking coil attached to a front surface of the focusing coil in such a manner that the tracking coil faces the permanent magnet;

a gel holder installed on a second end of the upper surface of the yoke plate, the second end being opposite to the first end;

an object lens holder disposed above the first end of the upper surface of the yoke plate in such a manner that the object lens holder surrounds the first and second yoke plates;

a flexible PCB which is directly connected to both focusing and tracking coils in order to transfer an electric signal from an electric source to the focusing and tracking coils; and

a pair of first suspension wires and a pair of second wires which suspend the object lens holder and permit the object lens holder to move in a focusing direction or a tracking direction, the first and second suspension wires being provided between the gel holder and the object lens holder, the pair of the first suspension wires being spaced parallel to the pair of the second suspension wires.

2. The optical pick-up apparatus as claimed in claim 1, wherein the object lens holder is formed with a rectangular opening within which the first and second yokes are positioned, both sides of the focusing and tracking coils being adhered to side walls of the rectangular opening.

3. The optical pick-up apparatus as claimed in claim 2, wherein a

through hole is formed at a rear inner wall of the rectangular opening, each end portion of the focusing and tracking coils being extended out of the object lens holder by passing through the through hole and connected to the flexible PCB.

4. The optical pick-up apparatus as claimed in claim 1, wherein the gel holder is formed at a front surface thereof with first and second recesses filled up with a damping gel, the object lens holder is formed at a predetermined portion of a rear surface thereof with third and fourth recesses which are filled up with the damping gel and are positioned corresponding to the first and second recesses, respectively, first ends of the pair of first suspension wires are fixed to a rear surface of the gel holder by passing through the first recess, second ends of the pair of first suspension wires, which are positioned opposite to the first ends, are fixed to a front surface of the object lens holder by passing through the third recess, third ends of the pair of second suspension wires are fixed to the rear surface of the gel holder by passing through the second recess, and fourth ends of the pair of second suspension wires, which are positioned opposite to the third ends, are fixed to the front surface of the object lens holder by passing through the fourth recess.

5. The optical pick-up apparatus as claimed in claim 4, wherein the object lens holder includes an upper object lens holder on which an object lens is installed and a lower object lens holder attached to an underside of the upper object lens holder, the upper object lens holder being provided at the underside thereof with a pair of projections which are inserted into a pair of engage holes formed at an upper surface of the lower object lens holder.

6. The optical pick-up apparatus as claimed in claim 5, wherein the upper object lens holder is formed at a lower portion of a rear surface thereof with first and second reverse U-shaped cutting portions, and the lower object lens holder is formed at an upper portion of a rear surface thereof with first and second U-shaped cutting portions, the first reverse U-shaped cutting portion being incorporated with the first U-shaped cutting portion so as to form the third recess, the second reverse U-shaped cutting portion being incorporated with the second U-

shaped cutting portion so as to form the fourth recess.

7. The optical pick-up apparatus as claimed in claim 4, wherein the yoke plate is formed at the second end of the upper surface thereof with a pair of engage holes, and the gel holder is provided at an underside thereof with a pair of projection pins, the pair of projection pins being inserted into the pair of engage holes so that the gel holder is fixed to the upper surface of the yoke plate.

8. The optical pick-up apparatus as claimed in claim 4, wherein the gel holder includes an upper gel holder and a lower gel holder attached to an underside of the upper gel holder, the upper gel holder being provided at the underside thereof with a pair of projections which are inserted into a pair of engage holes formed at an upper surface of the lower gel holder.

9. The optical pick-up apparatus as claimed in claim 8, wherein the upper gel holder is formed at a lower portion of a front surface thereof with first and second reverse U-shaped cutting portions, and the lower gel holder is formed at an upper portion of a front surface thereof with first and second U-shaped cutting portions, the first reverse U-shaped cutting portion being incorporated with the first U-shaped cutting portion so as to form the first recess, the second reverse U-shaped cutting portion being incorporated with the second U-shaped cutting portion so as to form the second recess.

10. The optical pick-up apparatus as claimed in claim 8, wherein the lower gel holder is formed at an upper surface thereof with a guide groove through which the flexible PCB connected to the focusing and tracking coils is withdrawn out of the optical pick-up apparatus.

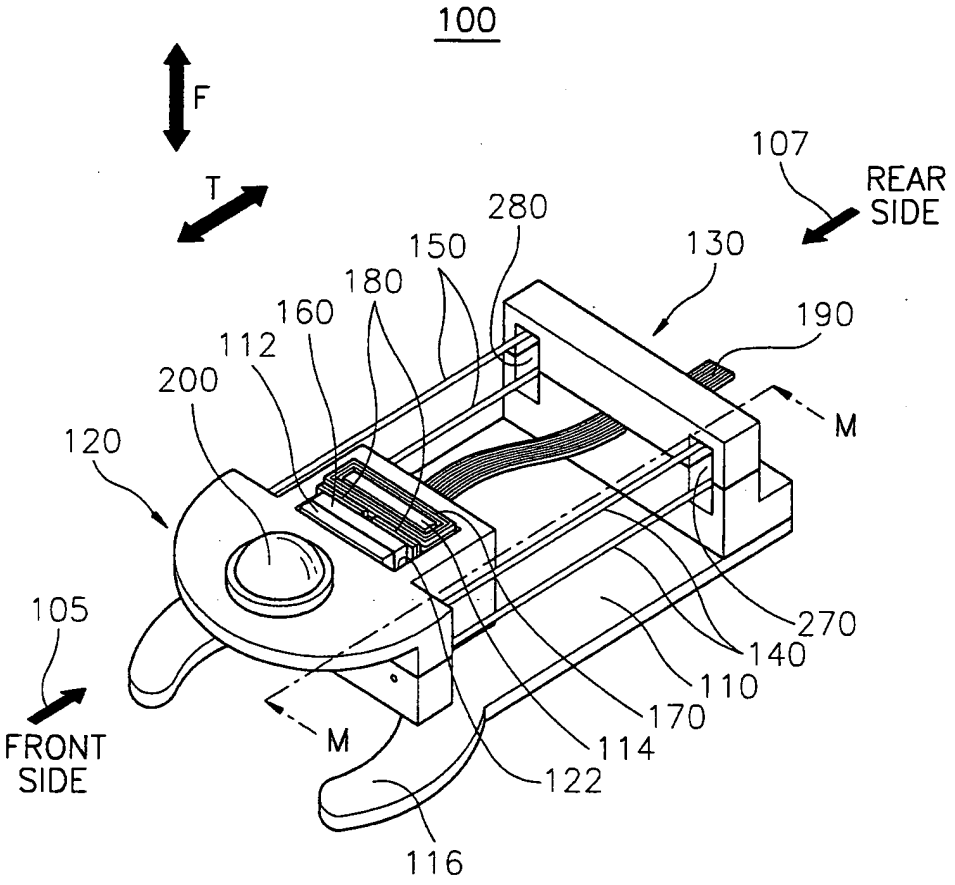
11. The optical pick-up apparatus as claimed in claim 4, wherein the object lens holder includes an upper object lens holder and a lower object lens holder attached to an underside of the upper object lens holder, the upper object lens holder being provided at the underside thereof with a pair of first projections

which are inserted into a pair of first engage holes formed at an upper surface of the lower object lens holder, the upper object lens holder being formed at a lower portion of a rear surface thereof with first and second reverse U-shaped cutting portions, the lower object lens holder being formed at an upper portion of a rear surface thereof with first and second U-shaped cutting portions, the first reverse U-shaped cutting portion being incorporated with the first U-shaped cutting portion so as to form the third recess, the second reverse U-shaped cutting portion being incorporated with the second U-shaped cutting portion so as to form the fourth recess, the gel holder including an upper gel holder and a lower gel holder attached to an underside of the upper gel holder, the upper gel holder being provided at the underside thereof with a pair of second projections which are inserted into a pair of second engage holes formed at an upper surface of the lower gel holder, the upper gel holder being formed at a lower portion of a front surface thereof with third and fourth reverse U-shaped cutting portions, the lower gel being formed at an upper portion of a front surface thereof with third and fourth U-shaped cutting portions, the third reverse U-shaped cutting portion being incorporated with the third U-shaped cutting portion so as to form the first recess, the fourth reverse U-shaped cutting portion being incorporated with the fourth U-shaped cutting portion so as to form the second recess.

12. The optical pick-up apparatus as claimed in claim 11, wherein the pair of first suspension wires include an upper suspension wire and a lower suspension wire, a first end of the upper suspension wire being fixed to a rear surface of the upper gel holder by passing through the third reverse U-shaped cutting portion, a second end of the upper suspension wire, which is positioned opposite to the first end of the upper suspension wire, is fixed to a front surface of the upper object lens holder by passing through the first reverse U-shaped cutting portion, a third end of the lower suspension wire being fixed to a rear surface of the lower gel holder by passing through the third U-shaped cutting portion, and a fourth end of the lower suspension wire, which is positioned opposite to the third end, is fixed to a front surface of the lower object lens holder by passing through the first U-shaped cutting portion.

13. The optical pick-up apparatus as claimed in claim 11, wherein the pair of second suspension wires include an upper suspension wire and a lower suspension wire, a first end of the upper suspension wire being fixed to a rear surface of the upper gel holder by passing through the second reverse U-shaped cutting portion, a second end of the upper suspension wire, which is positioned opposite to the first end of the upper suspension wire, is fixed to a front surface of the upper object lens holder by passing through the second reverse U-shaped cutting portion, a third end of the lower suspension wire being fixed to a rear surface of the lower gel holder by passing through the fourth U-shaped cutting portion, and a fourth end of the lower suspension wire, which is positioned opposite to the third end, is fixed to a front surface of the lower object lens holder by passing through the second U-shaped cutting portion.

FIG. 1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FRONT SIDE
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FIG. 2

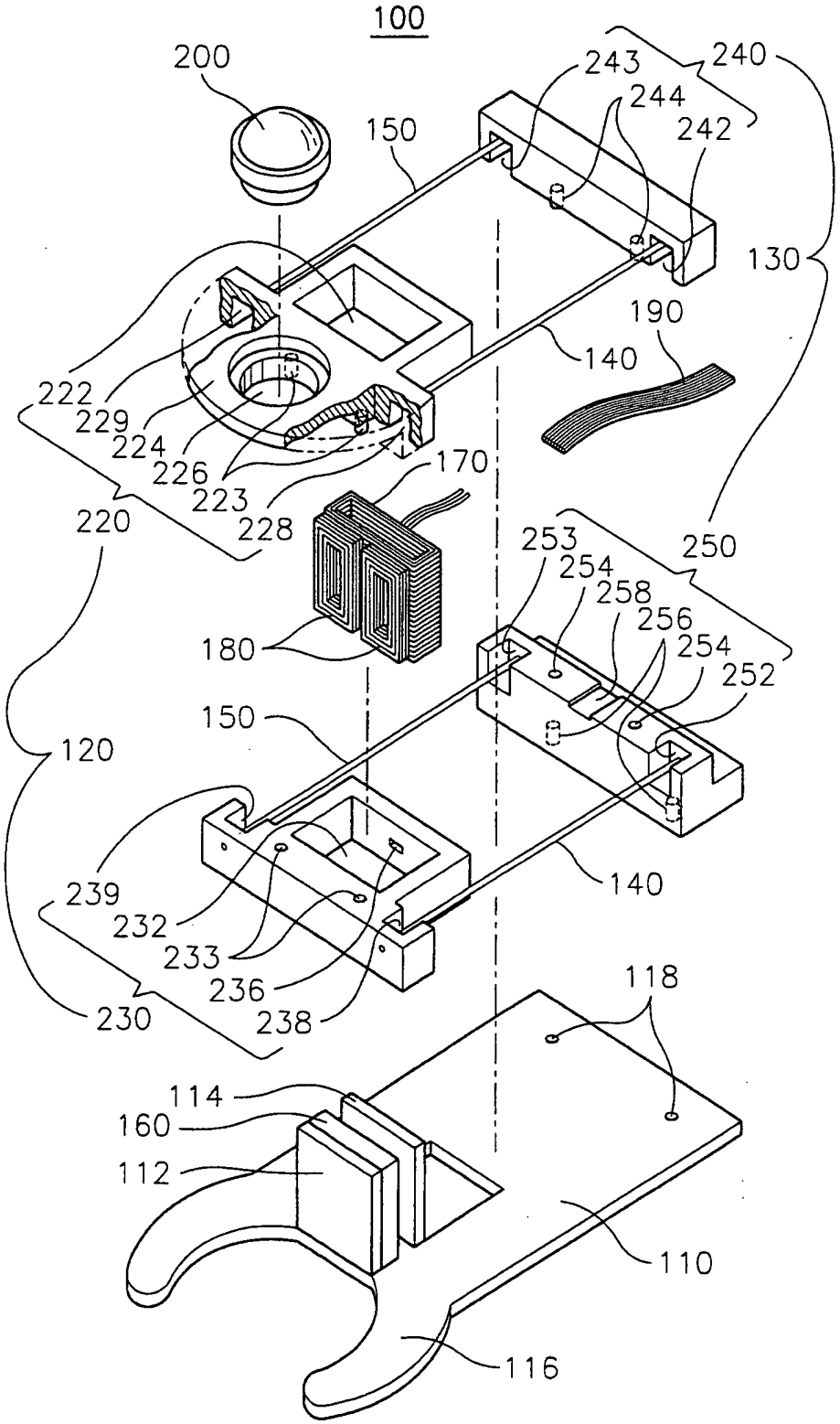
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FIG. 3

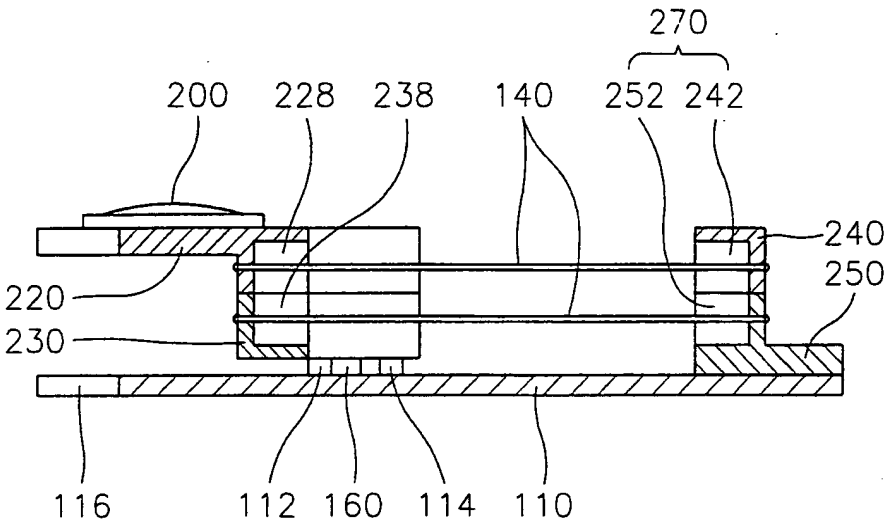
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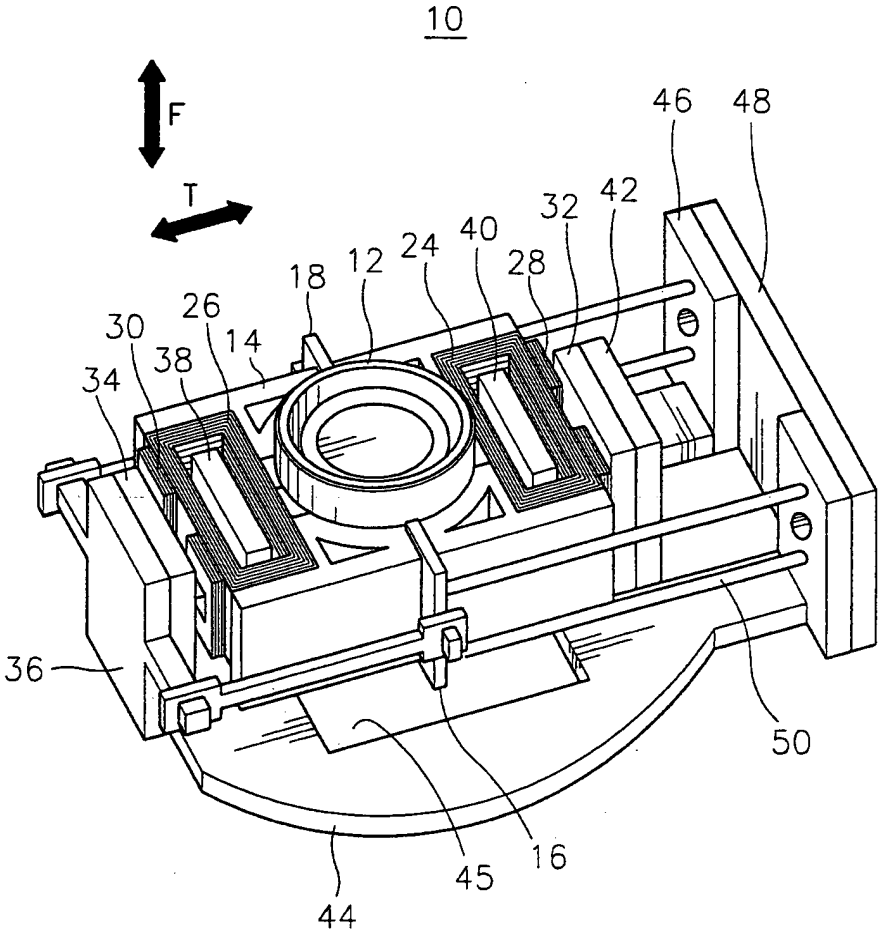
FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 98/00075

A. CLASSIFICATION OF SUBJECT MATTER

IPC[6]: G 11 B 7/09,21/02,11/10; H 01 R 35/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[6]: G 11 B 7/00,11/00,21/00; H 01 R 35/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 09-106 589 A (ALPINE ELECTRON INC.) 22 April 1997 (22.04.97), fig.1,2. &	1
Y,P	Patent Abstracts of Japan, Vol.97, No.8, 1997, JP 09-106589 A (ALPINE ELECTRON INC.).	
Y	Patent Abstracts of Japan, Vol.95, No.5, 1995, JP 07-037662 A (TOSHIBA CORP.).	1
A	Patent Abstracts of Japan, Vol.96, No.9, 1996, JP 08-129768 A (MATSUSHITA ELECTRIC IND. CO.).	1-13

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 June 1998 (17.06.98)	30 June 1998 (30.06.98)
Name and mailing address of the ISA/ AT AUSTRIAN PATENT OFFICE Kohlmarkt 8-10 A-1014 Vienna Facsimile No. 1/53424/535	Authorized officer Berger Telephone No. 1/53424/453

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR 98/00075

In Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
JP A2 9106589	22-04-97	keine - none - rien	